

**What is claimed is:**

1        1. A method of recycling a photoresist developer  
2        solution containing tetra-methyl-ammonia hydroxide  
3        (TMAH), comprising:  
4                selecting m wavelengths between 220 nm and 250 nm,  
5                wherein m is equal to or larger than 2;  
6                measuring absorption values Y<sub>1</sub> to Y<sub>m</sub> of the recycled  
7                developer solution at the m wavelengths  
8                respectively and an absorption value A<sub>1</sub> at  
9                wavelength 210 nm;  
10                inputting the Y<sub>1</sub> to Y<sub>m</sub> to an nth-degree polynomial,  
11                 $Y = C_1X^n + \dots + C_{n-1}X + C_n$ , to generate a wavelength-  
12                absorption relationship, wherein X is  
13                wavelength, n is a positive integer, and C<sub>1</sub> to  
14                C<sub>n</sub> are coefficients of the relation;  
15                inputting wavelength 210 nm into the wavelength-  
16                absorption relationship to generate an  
17                absorption value Y<sub>210</sub>;  
18                calculating a difference A<sub>3</sub> between the A<sub>1</sub> and Y<sub>210</sub>  
19                as the absorption value of TMAH in the  
20                developer solution;  
21                inputting A<sub>3</sub> to an absorption calibration curve of  
22                TMAH at 210 nm to generate a corresponding TMAH  
23                concentration; and  
24                adding TMAH into the recycled developer solution  
25                according to the corresponding TMAH  
26                concentration for reuse.

1           2. The method as claimed in claim 1, wherein the m  
2 wavelengths are selected with an interval of 5 nm or 10  
3 nm.

1           3. The method as claimed in claim 2, wherein the m  
2 wavelengths are the 7 wavelengths 220 nm, 225 nm, 230 nm,  
3 235 nm, 240 nm, 245 nm and 250 nm.

1           4. The method as claimed in claim 1, wherein the  
2 nth-degree polynomial is a 2nd- to 5th-degree polynomial.

1           5. The method as claimed in claim 4, wherein the  
2 nth-degree polynomial is a 3rd-degree polynomial as in  
3  $Y=C_1X^3+C_2X^2+C_3X+C_4$ .

1           6. The method as claimed in claim 1, further  
2 comprising the steps of:

3           diluting the recycled developer solution when the  
4           absorption value  $A_1$  at the wavelength 210 nm  
5           exceeds 1.2;

6           re-measuring absorptions of the diluted recycled  
7           developer solution at the m wavelength and 210  
8           nm as  $Y_1$  to  $Y_m$  and  $A_1$ .

1           7. A method for recycling a photoresist developer  
2           solution containing tetra-methyl-ammonia hydroxide  
3           (TMAH), comprising:

4           measuring absorption values  $A_1$  and  $A_2$  of the  
5           recycled developer solution at wavelength 210  
6           nm and 220nm;

7           calculating an absorption value  $A_3$  of TMAH in the  
8           developer solution by  $A_3 = A_1 - A_2 \times C_0$ , wherein  $C_0$

15                   inputting A3 to an absorption calibration curve of  
16                   TMAH at 210 nm to generate a corresponding TMAH  
17                   concentration; and

18 adding TMAH into the recycled developer solution  
19 according to the corresponding TMAH  
20 concentration for reuse.

8. The method as claimed in claim 7, further comprising the steps of:

diluting the recycled developer solution when the absorption value  $A_{1\text{0}}$  at the wavelength 210 nm exceeds 1.2;

re-measuring absorptions of the diluted recycled developer solution at wavelengths 210 nm and 220nm as A1 and A2.

9. A recycling system of a photoresist developer solution containing tetra-methyl-ammonia hydroxide (TMAH), comprising:

a recycle tank collecting the recycled developer solution from a photoresist development system via a recycle pipeline:

an adjustment tank loaded with highly concentrated TMAH and connected to the recycle tank with an adjustment pipeline:

10           a spectrometer for measuring absorption values of  
11           the developer solution in the recycle tank;  
12           a processor connecting to the spectrometer and the  
13           adjustment pipeline, programmed to calculate a  
14           TMAH concentration in the recycle tank  
15           according to the measured absorption values  
16           from the spectrometer and delivering an amount  
17           of highly concentrated TMAH from the adjustment  
18           pipeline to the recycle tank to achieve a  
19           desired TMAH concentration according to the  
20           calculated TMAH concentration, wherein the  
21           processor is programmed to calculate the TMAH  
22           concentration in the recycle tank by the  
23           following steps:

24           reading absorption values  $Y_1$  to  $Y_m$  on  $m$  wavelengths  
25           between 220 nm and 250 nm of the recycled  
26           developer solution respectively, wherein  $m$  is  
27           equal to or larger than 2, and an absorption  
28           value  $A_1$  of 210 nm;

29           inputting the  $Y_1$  to  $Y_m$  to an  $n$ th-degree polynomial  
30           to generate a wavelength-absorption  
31           relationship  $Y = C_1X^n + \dots + C_{n-1}X + C_n$ , wherein  $X$  is  
32           wavelength,  $n$  is a positive integer and  $C_1$  to  
33            $C_n$  are coefficients of the relation;

34           inputting wavelength 210 nm into the wavelength-  
35           absorption relationship to generate an  
36           absorption value  $Y_{210}$ ;

37           calculating a difference  $A_3$  between the  $A_1$  and  $Y_{210}$   
38           as the absorption value of TMAH in the  
39           developer solution; and

40           inputting A3 to an absorption calibration curve of  
41           TMAH at 210 nm to generate a corresponding TMAH  
42           concentration in the recycle tank.

1           10. The recycling system as claimed in claim 9,  
2           wherein the processor is a computer.

1           11. The recycling system as claimed in claim 9,  
2           wherein the m wavelengths are selected with an interval  
3           of 5 nm or 10 nm.

1           12. The recycling system as claimed in claim 11,  
2           wherein the m wavelengths are the 7 wavelengths 220 nm,  
3           225 nm, 230 nm, 235 nm, 240 nm, 245 nm and 250 nm.

1           13. The recycling system as claimed in claim 9,  
2           wherein the nth-degree polynomial is a 2nd- to 5th-degree  
3           polynomial.

1           14. The recycling system as claimed in claim 13,  
2           wherein the nth-degree polynomial is a 3rd-degree  
3           polynomial as in  $Y=C_1X^3+C_2X^2+C_3X+C_4$ .

1           15. The recycling system as claimed in claim 9,  
2           further comprising a dilutor for diluting the recycled  
3           developer solution when the absorption value A1 at the  
4           wavelength 210 nm exceeds 1.2.

1           16. A recycling system of a photoresist developer  
2           solution containing tetra-methyl-ammonia hydroxide  
3           (TMAH), comprising:

4           a recycle tank collecting the recycled developer  
5            solution from a photoresist development system  
6            via a recycle pipeline;  
7           an adjustment tank loaded with highly concentrated  
8            TMAH and connected to the recycle tank with an  
9            adjustment pipeline;  
10          a spectrometer for measuring absorption values of  
11           the developer solution in the recycle tank;  
12          a processor connected to the spectrometer and the  
13           adjustment pipeline, programmed to calculate a  
14           TMAH concentration in the recycle tank  
15           according to the measured absorption values  
16           from the spectrometer and delivering an amount  
17           of highly concentrated TMAH from the adjustment  
18           pipeline to the recycle tank to achieve a  
19           desired TMAH concentration according to the  
20           calculated TMAH concentration, wherein the  
21           processor is programmed to calculate the TMAH  
22           concentration in the recycle tank by the  
23           following steps:  
24          reading absorption values A1 and A2 of the recycled  
25           developer solution at wavelength 210 nm and 220  
26           nm;  
27          calculating an absorption value A3 of TMAH in the  
28           developer solution by  $A3 = A1 - A2 \times Co$ , wherein  $Co = (A1' - A3') / A2'$ , A1' and A2' are absorption  
29           values of a recycled developer solution with  
30           known TMAH concentration at wavelengths 210 nm  
31           and 220 nm respectively, and A3' is the

33 standard absorption value of the known TMAH  
34 concentration at 210 nm;  
35 inputting A3 to an absorption calibration curve of  
36 TMAH at 210 nm to generate a corresponding TMAH  
37 concentration in the recycle tank.

1 17. The recycling system as claimed in claim 16,  
2 wherein the processor is a computer.

1 18. The recycling system as claimed in claim 16,  
2 further comprising a dilutor for diluting the recycled  
3 developer solution when the absorption value A1 at the  
4 wavelength 210 nm exceeds 1.2.